

**DEPARTMENT OF TRANSPORTATION**

DIVISION OF ENGINEERING SERVICES

OFFICE ENGINEER

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*Serious Drought.  
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May 1, 2015

04-CC-4-0.0/4.9

04-3E3904

Project ID 0412000302

Addendum No. 2

Dear Contractor:

This addendum is being issued to the contract for CONSTRUCTION ON STATE HIGHWAY IN CONTRA COSTA COUNTY IN AND NEAR HERCULES FROM SAN PABLO AVENUE TO CUMMINGS SKYWAY OVERCROSSING.

Submit bids for this work with the understanding and full consideration of this addendum. The revisions declared in this addendum are an essential part of the contract.

Bids for this work will be opened on Wednesday, May 13, 2015.

This addendum is being issued to the *Notice to Bidders and Special Provisions*.

In the Special Provisions, Section 86-5.03, "VEHICLE SENSOR NODES REPLACEMENT," is added as attached.

To *Bid* book holders:

Inquiries or questions in regard to this addendum must be communicated as a bidder inquiry and must be made as noted in the *Notice to Bidders* section of the *Notice to Bidders and Special Provisions*.

Submit the *Bid* book as described in the *Electronic Bidding Guide* at the Bidders' Exchange website.

**[http://www.dot.ca.gov/hq/esc/oe/electronic\\_bidding/electronic\\_bidding.html](http://www.dot.ca.gov/hq/esc/oe/electronic_bidding/electronic_bidding.html)**

Inform subcontractors and suppliers as necessary.

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This addendum, EBS addendum file and attachments are available for the Contractors' download on the Web site:

**[http://www.dot.ca.gov/hq/esc/oe/project\\_ads\\_addenda/04/04-3E3904](http://www.dot.ca.gov/hq/esc/oe/project_ads_addenda/04/04-3E3904)**

If you are not a *Bid* book holder, but request a book to bid on this project, you must comply with the requirements of this letter before submitting your bid.

Sincerely,



BIJAN SARTIPI  
District Director

Attachments

**Add to section 86-5:**

**86-5.03 VEHICLE SENSOR NODES REPLACEMENT**

**86-5.03A General**

**86-5.03A(1) Summary**

Section 86-5.03 includes specifications for replacing vehicle sensor nodes in the roadway.

**86-5.03A(2) Definitions**

**AP:** wireless access point.

**FCC:** Federal Communications Commission.

**RP:** wireless repeater

**TIA:** Telecommunications Industry Association.

**VSN:** Vehicle Sensor Node.

**WVDS:** wireless vehicle detector system.

**86-5.03A(3) Submittals**

Submit the following:

1. Documentation that defines the VSN's communication protocol (message structure organization, data packet length as well as information necessary to make use of such messages).
2. Software to configure VSN with the AP and RP and store and retrieve detection data and for the performance analysis at each site and also the software updates from the manufacturer during warranty period. The Department does not pay for software and software updates.
3. Documentation used to configure the VSN with the AP and RP and to store and retrieve detection data.
4. Documentation required for maintenance and operation of the VSN.
5. The original recording medium and documentation that supports the accuracy analysis of VSN. Submit an additional copy of this documentation for maintenance and operation.
6. Recorded medium and other materials at the conclusion of the performance test.
7. Warranty documentation before installation.

**86-5.03A(4) Quality Control and Assurance**

**86-5.03A(4)(i) Functional Capabilities**

The wireless communications link between the VSN and WVDS, RP, and AP must comply with FCC rules.

The communication protocol must be open and freely available for use in the public domain.

The VSN must be reconfigurable over the wireless interface and capable to avoid interference from other users of the communication band during reconfiguration.

The link budget must be 93 dB or more.

The VSN must respond within 100 seconds after associated AP is powered on.

The VSN system must provide the following measurements per lane:

1. Vehicle count in a data collection interval in units of vehicles.
2. Percent occupancy in a data collection interval in units of 0.05 percent.

3. Vehicle speed. If more than one VSN installed per lane:
  - 3.1. Per vehicle in units of mph.
  - 3.2. Mean speed in a data collection interval in units of mph.
  - 3.3. Distribution of vehicle speeds in a data collection interval in bins of <30 mph, 30-34 mph, 35-39 mph, 75-79 mph, and 80 or more mph in units of vehicles.
4. Vehicle length if more than one VSN installed per lane:
  - 4.1. Per vehicle in units of 0.1 feet.
  - 4.2. Distribution of vehicles length in a data collection interval in bins of <20.0 feet, 20.0-39.9 feet, 40.0-59.9 feet, and 60 or more feet in units of vehicles.

The time interval for data collection must be user-selectable at a minimum of 30-seconds intervals. The time interval for reporting must be user-selectable from a list containing at minimum, 30 seconds, 1 minute, 5 minutes, 15 minutes, 1 hour, and 24 hours.

Each VSN must have the following programmable event reporting parameters:

1. Transmit interval from a minimum value of 6 seconds.
2. Reporting latency from a minimum range of 6 to 30 seconds.
3. Vehicle presence pulse modes.
4. RF watchdog timer.
5. Synchronize event reporting to AP clock or to detection events.
6. Speed Trap measurement/time interval between 2 consecutive VSNs.

Each VSN must be individually addressable with a unique identifier, and capable of transmitting to the AP. Each VSN must also be capable of receiving detector parameters, microprocessor firmware and other commands from the AP without loss of data.

Each VSN must have the following programmable detection parameters:

1. Onset sensitivity and delay
2. Off sensitivity
3. Holdover time
4. Adaptable orientation
5. Auto recalibration timeout within 5 minutes in the event of a detector lock

The VSN must have the capability of outputting the state of each detection 1 or 0 in real time in sync with each vehicle passage event for the traffic. This data must be available electronically via the TIA/EIA-232 or TIA/EIA-485 or Ethernet communication port in a well documented format.

#### **86-5.03A(4)(ii) Acceptance Testing**

Quality assurance test and demonstration must start at a date and time specified by the Engineer.

Notify the Engineer 15 working days before the location is ready for acceptance testing.

Conduct acceptance testing during a normal work day between the hours of 0800 and 1600. Demonstrate the operation of all VSN units satisfying the functional requirements. The Engineer has the right to reject the VSNs, if the demonstration fails.

Verify accuracy by comparing the VSN vehicle counts to recorded video image counts for the same period.

Accuracy testing must be done at 5 percent of the VSN locations as selected by the Engineer.

Provide clear and visible recorded video images for at least one peak period for all lanes that the VSN was installed in. The recorded video images must show the viewed detection scene, detectors operation, and the vehicle traffic count.

Time-stamp to 1/100 of a second must be made available so that the data can be overlaid on the recorded video. Transfer the 6-hour analysis periods and associated time synced data to a DVD for viewing on a PC.

Provide a means for synchronizing the test start and end times or provide software that displays time stamped VSN data along with the video images of the moving vehicles.

The following video recording and analysis options that depend on the available traffic conditions are acceptable; however the heaviest expected traffic conditions should be used, if possible. The minimum analysis period must be:

1. 30 minutes when the recording includes congested traffic (vehicles traveling at less than 20 mph for 5 or more minutes in any lane).
2. 45 minutes when the traffic flow exceeds 1500 vehicles per hour in any lane during the test period.
3. 60 minutes when the flow is less than 1500 vehicles per hour in every lane.
4. The analysis must be based on a minimum of 500 detected vehicles in every lane and cover the same time period for all lanes. The time periods within the selected video will be selected by the Engineer. The total vehicle count for every lane must be used and include the first and last partial vehicles for each lane.

Errors in the start and finish of the VSN and manual counts are included in the performance criterion as specified. Each real vehicle in the video should be identified as either detected correctly (DC), missed, (M), or over counted (OC).

VSN unit count must be compared to vehicle counts under traffic conditions specified above. The data accuracy must be determined by the formula:

$$\text{Accuracy (Absolute Value)} = 100\{1 - (\text{TC} - \text{VC}) / \text{TC}\}$$

where TC = Traffic Count derived from the media recording and  
VC = VSN reported count over the same period of time.

Average overall accuracy must be greater than 95 percent across all lanes. Minimum accuracy for each time period must be greater than 90 percent per lane. The Engineer will review the results from the acceptance testing and accept or reject the results within 7 days. The Engineer determines any vehicle anomalies or unusual occurrences. Data or counts that are not agreed upon are considered errors and count against the unit's calibration. If the Engineer rejects the VSN performance analysis, you have seven days to re-calibrate and re-test the unit and re-submit new test data. Following three failed attempts, you must replace the VSN system with a new unit.

**86-5.03A(4)(iii) Warranty**

Furnish a 2-year replacement warranty including software updates from the manufacturer of the VSN components against any defects or failures. The effective date of the warranty is the date of installation. Furnish replacement VSN components within 10 days after receipt of the failed parts. The Department does not pay for the replacement or for software updates. Deliver replacement VSN components and software updates to the following department maintenance electrical shop:

CALTRANS-DISTRICT 4  
MAINTENANCE ELECTRICAL SHOP  
30 RICKARD STREET  
SAN FRANCISCO, CA 94134  
TEL. (415) 330-6500

**86-5.03B Materials****86-5.03B(1) General**

The VSN replacement includes VSN, epoxy sealant, testing, calibration with the existing WVDS and salvaging the existing VSN.

VSN components must be manufactured by Sensys Networks, Incorporated, 2560 Ninth Street, Suite 219, Berkeley, CA 94710, telephone (510) 548-4620.

VSN components must be new. The manufacturing date of VSN components as shown by date codes or serial numbers of electronic circuit assemblies must be within 6 months from the date of installation.

Prices for components not including taxes or shipping are:

Part Number	Description	Quantity					
		1-99					
900-240-100-0-000	VSN240-F-2 Flush Mount Sensor	\$480					
900-240-100-0-005	VSN240-EPX Epoxy sealant for sensor	\$68					

The above prices are accurate for orders placed before July 31, 2015 if delivery is accepted within 90 days from order date.

**86-5.03B(2) Vehicle Sensor Node**

Each VSN consists of a magnetometer sensor, a microprocessor with firmware in non-volatile memory, a wireless transceiver, and a battery in a single housing.

The housing must be fully encapsulated and provide normal life of 8 years of operation over a temperature range of -34 to 165 degrees F. The housing must fit in a cylindrical hole no larger than 4.00 inches in diameter and 3.00 inches deep.

**86-5.03B(3) Sealant**

The sealant for VSN installation must be a self-leveling joint sealant and must be applied at a minimum temperature of 32 degree F.

**86-5.03C Construction**

Remove existing VSN. Comply with section 14-11.10 'Disposal of Electrical Equipment Requiring Special Handling'.

CONTRACT NO. 04-3E3904  
ADDED PER ADDENDUM NO. 2 DATED MAY 1, 2015

Procure VSN components directly from manufacturer.

Provide the following:

1. All equipment, documentation, materials and special tools required for acceptance testing of the system.
2. All software required to program, reconfigure and support the VSN installed at the time of acceptance testing.
3. Arrange for manufacturer representative to be present during installation and calibration of VSN.

Comply with the manufacturer's instructions and these special provisions for the installation and materials used.

Before the installation of any VSN component:

1. Obtain the Engineer's approval for the exact location.
2. Demonstrate that components will operate independently and will not interfere with other components at any other site or other equipment in the vicinity.
3. Demonstrate that each VSN will be installed within range of its corresponding AP and is located with a 60-degree horizontal cone, measured from perpendicular.
4. Test all VSNs and demonstrate proper operation and communication between the VSN and the AP.

Keep the maximum distance between a VSN and the AP as follows:

AP mounting height	Maximum distance from VSN to AP
12 feet	75 feet
18 feet	105 feet
24 feet	150 feet

Clear the surface to be bonded and remove debris, moisture and anything else that interferes with the sealant bond.

Install new VSN in the roadway. Clean holes cored in the pavement and thoroughly dry before installing VSN. Do not allow residue resulting from core drilling to flow across shoulders or lanes occupied by traffic. Remove residue from the pavement surface by vacuuming or other approved method before any residue flows off of the pavement surface. Dispose of residue from core drilling. Backfill the cored pavement per manufacturer's instructions. Remove any excess epoxy sealant from the roadway without the use of solvents.

Reconfigure and demonstrate successful communication between each VSN, and the AP after installation of all components.

Program the VSN and include a minimum of 16 channels per location to avoid interference from other users of the communication band during reconfiguration.

Install and orient the video camera so that traffic is visible in all lanes. The video field of view must totally encompass the area in which vehicles are detected.

Verify the performance of each site. The accuracy of each site must be determined and documented so that each site may be approved or rejected separately. Failure to submit the recorded medium and materials at the conclusion of testing invalidates the test. The recorded medium serves as acceptance evidence and must not be used for calibration. The calibration must have been completed prior to testing and verification.

The department does not pay for repairing, replacing, and retesting of VSN components due to failure or rejection.

#### **86-5.03D Payment**

Not used.